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Knowledge and Practice of Intensive Care Nurses in Preventing Ventilator-Associated Pneumonia in Erbil City

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Abstract **Background and Aim:** Ventilator-associated pneumonia (VAP) is a serious infection affecting ICU patients on mechanical ventilation, leading to increased health risks and costs. Nurses are key to VAP prevention, but their knowledge and practices vary. This study aimed to assess the knowledge and practice of ICU nurses in preventing VAP in Erbil City, Iraq. **Methods:** This cross-sectional study was conducted between October 2nd and December 29th, 2024, in three major public teaching hospitals in Erbil, using convenience sampling. Data were collected using two self-structured questionnaires covering sociodemographic variables, knowledge and practice related to VAP prevention. Statistical analysis was performed using Stata version 12 (StataCorp LLC, College Station, TX). Chi-square tests and ordinal regression analysis were used to examine associations between knowledge, practice and demographic characteristics, with significance set at $p<0.001$. **Results:** A total of 62 ICU nurses participated in the study. The mean knowledge score was 7.95 (SD = 1.89) and the mean practice score was 6.42 (SD = 1.59), indicating that the participants had moderate levels of knowledge and practice regarding ventilator-associated pneumonia (VAP) prevention. A significant association was found between knowledge levels and years of experience in ICU or respiratory care units, as well as with age. Practice levels were significantly associated with gender and years of experience, with male nurses and those with more experience demonstrating better adherence to recommended practices. **Conclusions:** The participants demonstrated a moderate level of knowledge and practice regarding VAP prevention. Policymakers and healthcare providers are recommended to implement targeted training programs and continuous professional development to enhance nurses' competencies and adherence to VAP prevention guidelines.

Key Words Ventilator-Associated Pneumonia, Intensive Care Nurses, Knowledge, Practice, Critical Care Nursing

INTRODUCTION

Ventilator-Associated Pneumonia (VAP) is a common and serious complication in critically ill patients receiving mechanical ventilation. It is defined as pneumonia that develops 48 hours or more after endotracheal intubation or within 48 hours after extubation [1]. VAP is associated with prolonged mechanical ventilation, increased length of stay in the Intensive Care Unit (ICU) and hospital, higher healthcare costs and increased mortality [2,3]. The incidence of VAP ranges from 9% to 27% of mechanically ventilated patients, depending on the diagnostic criteria used and the population studied [4,5]. The pathogenesis of VAP involves the interplay of several factors, including the endotracheal tube, which impairs natural defense mechanisms and facilitates the entry of bacteria into the lower respiratory tract; the accumulation of oropharyngeal secretions above the endotracheal tube cuff; the formation of biofilm on the endotracheal tube surface; and the aspiration of contaminated secretions into the lungs [4,6]. Risk factors for VAP include prolonged mechanical ventilation, prior antibiotic use, supine positioning, advanced age and comorbidities such as chronic obstructive pulmonary disease and immunosuppression [1].

Given the significant morbidity and mortality associated with VAP, prevention strategies are crucial in the management of mechanically ventilated patients. These strategies include a multidisciplinary approach involving various healthcare professionals, with nurses playing a

pivotal role in implementing evidence-based practices at the bedside [7,8]. Nurses are responsible for providing direct patient care, monitoring patients' conditions and ensuring adherence to infection control measures. Therefore, their knowledge and practice of VAP prevention are essential in reducing the incidence of this healthcare-associated infection. Several nursing interventions have been shown to reduce the risk of VAP, including elevating the head of the bed to 30-45 degrees, performing regular oral care with chlorhexidine, maintaining adequate endotracheal tube cuff pressure, providing subglottic secretion drainage and using closed suction systems [9,10]. The implementation of these interventions requires nurses to have a comprehensive understanding of the pathophysiology, risk factors and prevention strategies for VAP. However, studies have shown that nurses' knowledge and adherence to VAP prevention guidelines vary widely, highlighting the need for ongoing education and training [11,12].

In Erbil City, Iraq, the prevalence of VAP and its impact on patient outcomes have not been extensively studied. A recent study conducted in an ICU in Erbil found that the incidence of VAP was 16.8 per 1,000 ventilator days, with a higher risk of mortality among patients who developed VAP compared to those who did not [13]. This highlights the need for effective VAP prevention strategies in this setting. However, there is limited information on the knowledge and practice of ICU nurses regarding VAP prevention in Erbil City. Understanding nurses' current knowledge and practice is essential for identifying gaps and developing targeted interventions to improve the quality of care for mechanically ventilated patients.

Assessing nurses' knowledge and practice regarding VAP prevention is crucial for several reasons. First, it helps identify areas where nurses may lack sufficient knowledge or where their practice may not align with evidence-based guidelines. This information can be used to develop and implement educational programs and training sessions to enhance nurses' competencies in VAP prevention. Second, understanding the factors that influence nurses' knowledge and practice, such as years of experience, education level and previous training, can help tailor interventions to specific subgroups of nurses. Finally, evaluating the effectiveness of educational interventions on nurses' knowledge and practice can provide valuable insights into the impact of these programs on patient outcomes and guide future quality improvement initiatives. Therefore, this study aims to assess the knowledge and practice of intensive care nurses in preventing ventilator-associated pneumonia in Erbil City, Iraq.

Research Question

What is the level of knowledge and practice among intensive care nurses in preventing ventilator-associated pneumonia in Erbil City?

METHODS

Study Design, Setting, Period and Sampling

This cross-sectional study was conducted in Erbil City, Iraq, from October 2nd to December 29th, 2024. The study was carried out in three major public teaching hospitals with intensive care units: Rozhawa Emergency Hospital, Rojhalat Emergency Hospital and Hawler Teaching Hospital, using convenience sampling.

Sample Size

The sample size for this study was determined based on the total number of intensive care nurses available in the selected hospitals in Erbil. During the data collection period, there were 62 nurses working in the respiratory care units of the three selected public teaching hospitals.

Inclusion/exclusion

The inclusion criteria required participants to be nurses of either gender with nursing qualifications at the preparatory, diploma, or bachelor's level, currently working in the intensive care units and with at least one year of professional experience in this role. Nurses who were absent during the data collection period or declined to participate were excluded from the study.

Study Tools and Data Collection

The questionnaire was divided into three main parts. The first part gathered socio-demographic data, including age, gender, marital status, educational qualification, years of experience and previous training on VAP prevention. The second part assessed nurses' knowledge regarding VAP prevention and the third part evaluated their practical performance using an observational checklist. The tools were developed by the researchers based on a review of relevant literature and were provided in English, as nursing education in the region is conducted in English. Any unclear items were clarified by the researchers. Data were collected in the intensive care units and each participant was given 10-15 minutes to complete the questionnaire.

Pilot Study

The self-structured questionnaire was initially tested in a pilot study involving 10 nurses who were not included in the main study. The pilot study was conducted between April 12th and May 12th, 2024, to evaluate the internal consistency and reliability of the questionnaire items before use in the actual data collection. Cronbach's alpha was used to assess the internal consistency of the tool [14]. The knowledge section of the questionnaire demonstrated a reliability score of 0.84, indicating a very good level of internal consistency, while the practice checklist showed an overall Cronbach's alpha of 0.91, reflecting an excellent level of reliability. Data collected during the pilot study were excluded from the final analysis.

Measures

Sociodemographic Characteristics

The first section of the questionnaire collected sociodemographic information of the intensive care nurses. This included age, gender, marital status, highest educational qualification, years of experience in intensive care and prior training on the prevention of VAP. These variables were included to explore potential associations with the nurses' knowledge and practice levels regarding VAP prevention.

Knowledge Assessment Tool

To assess the knowledge and practices of intensive care nurses related to the prevention of ventilator-associated pneumonia, a self-structured questionnaire and observational checklist were developed by the researchers based on relevant literature and expert consultation. The knowledge component included 15 multiple-choice items designed to evaluate nurses' understanding of evidence-based VAP prevention measures. Scores ranged from 0 to 15 and were categorized into three levels: Poor (0-5), fair (6-10) and good (11-15). Higher scores reflected better knowledge of VAP prevention strategies.

Practice Assessment Tool

The practice component consisted of a 15-item observational checklist covering essential practices such as hand hygiene, oral care, endotracheal tube cuff pressure monitoring, aspiration precautions and respiratory care techniques. Each correctly performed practice was scored as 1 and incorrectly or unperformed practices scored as 0, with a total score ranging from 0 to 15. Practice levels were similarly categorized into poor (0-5), fair (6-10) and good (11-15), allowing for objective evaluation of adherence to recommended VAP prevention protocols.

Ethical Approval and Informed Consent

This study adhered to the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Scientific and Ethics Committee of the College of Nursing at Hawler Medical University. Verbal informed consent was obtained from all participants prior to data collection and the purpose and procedures of the study were clearly explained to them.

Statistical Analysis

Data were summarized and reported with frequency and percentage for qualitative variables. Quantitative variables were presented with means and standard deviations. As the data were not normally distributed, the Chi-square test was used to assess the association between nurses' knowledge and practice levels and their demographic characteristics. To further confirm these relationships and account for potential influencing factors, ordinal regression analysis was applied. A p-value of less than 0.001 was considered statistically significant. All statistical analyses were performed using Stata version 12 (StataCorp LLC, College Station, TX).

RESULTS

Demographic and Clinical Characteristics

The study involved 62 participants, predominantly male (53.2%, 33), married (85.5%, 53), aged 31-40 years (56.5%, 35) with a mean age of 37.6±8.26 years and holding a diploma degree (75.8%, 47). Most had 11-15 years of professional experience in respiratory or intensive care units (42.0%, 26) but lacked training in VAP prevention (88.7%, 55). Participants demonstrated moderate levels of knowledge (mean score: 7.95±1.89) and practices (mean score: 6.42±1.59) related to VAP, with the majority exhibiting fair knowledge (80.6%, 50) and fair practices (69.4%, 43). Detailed demographics and other variables are presented in Table 1.

Table 1: Demographic and Clinical Characteristics of Participants

Variables	Characteristics n = 62	F	%
Age (year)	21-30	10	16.1
	31-40	35	56.5
	41-50	11	17.7
	51-60	6	9.7
	Mean ± SD	37.6 ± 8.26	
Gender	Male	33	53.2
	Female	29	46.8
Marital status	Single	9	14.5
	Married	53	85.5
Professional qualification	Diploma degree	47	75.8
	Bachelor degree	15	24.2
Total years of professional experience in respiratory or intensive care units	1-5	19	30.6
	6-10	14	22.6
	11-15	26	42
	16-20	1	1.6
	21-25	2	3.2
Attendance in a training course on VAP prevention	Yes	7	11.3
	No	55	88.7
Knowledge levels	Poor	8	12.9
	Fair	50	80.6
	Good	4	6.5
	Mean ± SD	7.95 ± 1.89	
Practice levels	Poor	18	29
	Fair	43	69.4
	Good	1	1.6
	Mean ± SD	6.42 ± 1.59	

Note: F= Frequency, %= Percentage, SD= Standard deviation and VAP= Ventilator-Associated Pneumonia

Table 2: Distribution of Correct and Incorrect Responses to Knowledge Questions on Ventilator-Associated Pneumonia (VAP) Prevention Among ICU Nurses (N = 62)

Knowledge questions	Incorrect answer		Correct answer		Mean Score
	F	%	F	%	0.45
Ventilator-associated pneumonia is defined as pneumonia occurring in patients receiving mechanical ventilation	34	54.8	28	45.2	0.44
Endotracheal tubes with an extra lumen help drain subglottic secretions	35	56.5	27	43.5	0.10
Recommended practice for maintaining adequate tracheal cuff pressure	56	90.3	6	9.7	0.60
Elevating the head of the bed is an effective VAP prevention measure	25	40.3	37	59.7	0.40
Use of kinetic standard beds aids in VAP prevention	37	59.7	25	40.3	0.80
Chest physiotherapy is a recommended practice for VAP prevention	11	17.7	51	82.3	0.23
Endotracheal suctioning is a routine part of ventilated patient care	48	77.4	14	22.6	0.60
Sterile gloves should be worn when caring for patients on mechanical ventilation	25	40.3	37	59.7	0.84
Suction catheters should be properly disposed of after use	10	16.1	52	83.9	0.32
Accidental extubating and frequent re-intubation increase the risk of VAP	42	67.7	20	32.3	0.63
The best solutions for regular and comprehensive oral care are...	23	37.1	39	62.9	0.50
Regular performance of oral care is recommended for ventilated patients	31	50.0	31	50.0	0.65
The choice of airway humidifier affects VAP prevention	22	35.5	40	64.5	0.60
Recommended frequency for changing humidifiers in ventilated patients	35	56.5	27	43.5	0.79
Early weaning from mechanical ventilation reduces VAP risk	13	21.0	46	79.0	0.45

F: Frequency, %: Percentage, SD: Standard deviation, VAP: Ventilator-Associated Pneumonia

Table 3: Distribution of Achieved and Not Achieved Responses to Practice Questions on Ventilator-Associated Pneumonia (VAP) Prevention Among ICU Nurses (N = 62)

Practice questions	Achieved		Not Achieved		Mean Score
	F	%	F	%	0.45
Perform hand hygiene before oral care and tracheal suction, and before/after patient contact	28	45.2	34	54.8	0.45
Wear sterile gloves before providing oral care and tracheal suction	12	19.4	50	80.6	0.19
Provide oral care using an antiseptic solution	42	67.7	20	32.3	0.68
Apply water-soluble jelly to the patient's lips after oral care	13	21.0	49	79.0	0.21
Ensure environmental cleanliness and proper sterilization	54	87.1	8	12.9	0.87
Use a closed endotracheal suction system	0	0.0	62	100	0.0
Sterilize or disinfect suctioning equipment after use	22	35.5	40	64.5	0.35
Use sterile technique during tracheal suctioning	7	11.3	55	88.7	0.11
Discard suction catheter after single use	8	12.9	54	87.1	0.13
Perform subglottic suctioning before cuff deflation or tube repositioning	22	35.5	40	64.5	0.35
Monitor and maintain adequate tracheal cuff pressure	48	77.4	14	22.6	0.77
Keep the patient in a semi-sitting position (30-45° angle)	51	82.2	11	17.8	0.82
Use kinetic beds for ventilated patients	59	95.2	3	4.8	0.95
Apply chest physiotherapy regularly	24	38.7	38	61.3	0.39
Perform proper documentation of VAP prevention practices	8	12.9	54	87.1	0.13

F: Frequency, %: Percentage, SD: Standard deviation, VAP

Distribution of Correct and Incorrect Responses to Knowledge Questions

The mean scores for individual questions range from 0.10 to 0.84, indicating varying levels of knowledge. The question with the lowest percentage of correct responses (9.7%, 6) relates to maintaining adequate tracheal cuff pressure, while the highest percentage of correct responses (83.9%, 52) pertains to the proper disposal of suction catheters. Notable findings include: 79.0% (46) correctly identified that early weaning from mechanical ventilation reduces VAP risk, 64.5% (40) knew the choice of airway humidifier affects VAP prevention and 62.9% (39) were aware of the best solutions for oral care. However, only 32.3% (20) recognized that accidental extubating and frequent re-intubation increase VAP risk (Table 2).

Distribution of Achieved and Not Achieved Responses to Practice Questions

The mean scores for individual questions range from 0.0 to 0.95, indicating varying levels of adherence to recommended practices. The question with the lowest percentage of achieved responses (0.0%, 0) relates to using a closed endotracheal suction system, while the highest percentage of achieved responses (95.2%, 59) pertains to using kinetic beds for ventilated patients. Other notable findings include: 87.1% (54) did not ensure environmental cleanliness and proper sterilization, 88.7% (55) did not use sterile technique during tracheal suctioning and 87.1% (54) did not discard suction catheters after single use. However, 82.2% (51) kept patients in a semi-sitting position (30°-45° angle) and 77.4% (48) monitored and maintained adequate tracheal cuff pressure (Table 3).

Association Between Knowledge Levels and Demographic Characteristics

The results showed that there was no statistically significant association between knowledge levels and age ($p = 0.49$), gender ($p = 0.62$), marital status ($p = 0.67$), or professional qualification ($p = 0.23$) among the 62 ICU nurses. However, a significant association was found between knowledge levels and total years of professional experience in respiratory or intensive care units ($p<0.001$). The majority of

Table 4: Association Between knowledge Levels and Demographic Characteristics (N = 62)

Item Variables		Level of Knowledge			p-value
		Poor N (%)	Fair N (%)	Good N (%)	
Age (in years)	21-30	0 (0.0)	10 (16.1)	0 (0.0)	0.49
	31-40	5 (8.1)	27 (43.5)	3 (4.8)	
	41-50	1 (1.6)	9 (14.5)	1 (1.6)	
	51-60	2 (3.2)	4 (6.5)	0 (0.0)	
Gender	Male	3 (4.8)	28 (45.2)	2 (3.2)	0.62
	Female	5 (8.1)	22 (35.5)	2 (3.2)	
Marital status	Single	1 (1.6)	8 (12.9)	0 (0.0)	0.67
	Married	7 (11.3)	42 (67.7)	4 (6.5)	
Professional qualification	Diploma degree	8 (12.9)	36 (58.1)	3 (4.8)	0.23
	Bachelor degree	0 (0.0)	14 (22.6)	1 (1.6)	
Total years of professional experience in respiratory or intensive care units	1-5	2 (3.2)	17 (27.4)	0 (0.0)	<0.001
	6-10	0 (0.0)	12 (19.4)	2 (3.2)	
	11-15	6 (9.7)	19 (30.6)	1 (1.6)	
	16-20	0 (0.0)	0 (0.0)	1 (1.6)	
	21-25	0 (0.0)	2 (3.2)	0 (0.0)	

N: Number, %: Percentage, chi-square was used to determine the relationship between knowledge levels and demographic data and statistical significance was set at p<0.001

Table 5: Association Between practice Levels and Demographic Characteristics (N = 62)

Item Variables		Level of Practice			p-value
		Poor N (%)	Fair N (%)	Good N (%)	
Age (in years)	21-30	2 (3.23)	8 (12.9)	0 (0)	0.49
	31-40	11 (17.74)	23 (37.1)	1 (1.61)	
	41-50	5 (8.06)	6 (9.68)	0 (0)	
	51-60	0 (0)	6 (9.68)	0 (0)	
Gender	Male	5 (8.06)	27 (43.55)	1 (1.61)	0.62
	Female	13(20.97)	16 (25.81)	0(0)	
Marital status	Single	3(4.84)	6 (9.68)	0(0)	0.67
	Married	15 (24.19)	37 (59.68)	1(1.61)	
Professional qualification	Diploma degree	12(19.35)	34 (54.84)	1(1.61)	0.23
	Bachelor degree	6(9.68)	9 (14.52)	0(0)	
Total years of professional experience in respiratory or intensive care units	1-5	5(8.06)	14 (22.58)	0(0)	<0.001
	6-10	4(6.45)	9 (14.52)	1(1.61)	
	11-15	8(12.9)	18 (29.03)	0(0)	
	16-20	1(1.61)	0(0)	0(0)	
	21-25	0 (0)	2 (3.23)	0(0)	

N: Number, %: Percentage, chi-square was used to determine the relationship between practice levels and demographic data and statistical significance was set at p<0.001

nurses with fair knowledge had 1-5 years (27.4%, 17) or 11-15 years (30.6%, 19) of experience, while those with poor knowledge were primarily in the 11-15 years category (9.7%, 6). Good knowledge was observed in nurses with 6-10 years (3.2%, 2) and 16-20 years (1.6%, 1) of experience (Table 4).

Association Between Practice Levels and Demographic Characteristics

The results showed that there was no statistically significant association between practice levels and age (p = 0.49), gender (p = 0.62), marital status (p = 0.67), or professional qualification (p = 0.23) among the 62 ICU nurses. However, a significant association was found between practice levels and total years of professional experience in respiratory or intensive care units (p<0.001). The majority of nurses with fair practice levels had 11-15 years (29.03%, 18) or 1-5 years (22.58%, 14) of experience, while those with poor practice levels were primarily in the 11-15 years (12.9%, 8) and diploma degree (19.35%, 12) categories. Good practice levels were observed in only one nurse with 6-10 years (1.61%, 1) of experience (Table 5).

Ordinal Regression Analysis of Demographic Variables Associated with Knowledge and Practice of VAP Prevention

The results showed that age was significantly associated with knowledge levels, with nurses aged 21-30 (Estimate = 2.41, p = 0.04, 95% CI: 0.17-4.64) and 31-40 (Estimate = 2.21, p = 0.04, 95% CI: 0.11-4.32) having higher knowledge levels compared to those aged 51-60. Gender was significantly associated with practice levels, with male nurses (Estimate = 1.50, p = 0.01, 95% CI: 0.39-2.61) having better practices than female nurses. Marital status and professional qualification were not significantly associated with either knowledge or practice levels. Years of experience in Respiratory Care Units (RCU) or Intensive Care Units (ICU) was significantly associated with knowledge levels, with nurses having 1-5 years (Estimate = -4.17, p = 0.02,

Table 6: Ordinal Regression Analysis of Demographic Variables Associated with Knowledge and Practice of VAP Prevention (N = 62)

Variable	Knowledge				Practice			
	Estimate	p-value	95% CI		Estimate	p-value	95% CI	
			LB	UB			LB	UB
Age								
21-30	2.41	0.04	0.17	4.64	2.24	0.05	0.01	4.47
31-40	2.21	0.04	0.11	4.32	0.87	0.41	-1.18	2.91
41-50	1.95	0.09	-0.27	4.17	0.11	0.92	-2.06	2.29
51-60	0a	-	-	-	0a	-	-	-
Gender								
Male	0.97	0.08	-0.11	2.05	1.50	0.01	0.39	2.61
Female	0a	-	-	-	0a	-	-	-
Marital Status								
Single	-0.18	0.83	-1.80	1.44	-0.26	0.76	-1.90	1.39
Married	0a	-	-	-	0a	-	-	-
Professional qualification								
Diploma degree	0.34	0.55	-0.78	1.47	0.19	0.74	-0.93	1.31
Bachelor degree	0a	-	-	-	0a	-	-	-
Years of experience in RCU or ICU								
1-5	-4.17	0.02	-7.60	-0.75	-0.14	0.93	-3.31	3.02
6-10	-2.47	0.16	-5.91	0.96	-0.11	0.95	-3.37	3.14
11-15	-5.50	0.00	-8.97	-2.04	-0.45	0.78	-3.56	2.66
16-20	-4.61	0.26	-6.63	-1.87	-0.39	0.88	-5.30	4.51
21-25	0a	-	-	-	0a	-	-	-

Statistical test: Ordinal regression analysis was used, Significance was set at p<0.001, aReference parameter ,F: Frequency, %: Percentage, M: Municipality, LB: Lower bound, UB: Upper bound

95% CI: -7.60 to -0.75) and 11-15 years (Estimate = -5.50, p<0.001, 95% CI: -8.97 to -2.04) of experience showing lower knowledge levels compared to those with 21-25 years of experience. However, years of experience was not significantly associated with practice levels (Table 6).

DISCUSSION

The present study aimed to assess the knowledge and practice of intensive care nurses in preventing VAP in Erbil City, Iraq. Overall, the results revealed that the nurses had a moderate level of knowledge and practice regarding VAP prevention.

VAP is a serious nosocomial infection that poses significant risks to critically ill patients on mechanical ventilation in intensive care units (ICUs) [15]. In Iraq, the prevalence of VAP remains high and preventive measures are not consistently implemented in many healthcare facilities. Despite the crucial role of ICU nurses in preventing VAP, there is limited research on their knowledge and practices in this area, particularly in the context of Erbil City. Given the importance of these issues, we sought to evaluate the knowledge and practice of ICU nurses in preventing VAP and identify factors influencing their competence.

The demographic characteristics of the study participants, consisting primarily of experienced ICU nurses with varying educational backgrounds, provide a representative sample of the nursing workforce in Erbil's critical care settings. The majority of nurses had more than five years of experience working in ICUs, which is consistent with global trends in critical care staffing [16]. This experienced cohort offers valuable insights into the current state of VAP prevention knowledge and practices among ICU nurses in the region. Moreover, our findings revealed that ICU nurses in Erbil City demonstrated a moderate level of knowledge and practice regarding VAP prevention. This suggests that while nurses have a basic understanding of VAP prevention strategies, there is still room for improvement in certain areas. Similar studies conducted in other developing countries have reported comparable levels of knowledge and practice among ICU nurses [11,17]. However, the unique challenges faced by healthcare systems in Iraq, such as limited resources and ongoing conflicts, may contribute to the gaps in VAP prevention competencies observed in our study.

The strong knowledge exhibited by nurses regarding the proper disposal of suction catheters highlights their understanding of fundamental infection control measures. This finding is encouraging, as it indicates that basic principles of infection prevention are well-established among ICU nurses in Erbil [18]. However, the moderate overall knowledge scores suggest that more complex aspects of VAP prevention, such as oral care and patient positioning, may require additional training and emphasis [19]. Nurses' consistent application of the semi-sitting position for patients is another positive finding, as it aligns with best practices for VAP prevention [20]. This suggests that ICU nurses in Erbil are aware of the importance of patient positioning in reducing the risk of VAP and are incorporating this practice into their daily care routines. However, the moderate overall practice scores indicate that other VAP prevention measures, such as regular oral care and subglottic suctioning, may not be implemented as consistently [21].

The significant association between professional experience and knowledge levels highlights the value of

hands-on training and clinical exposure in developing VAP prevention competencies. Nurses with more years of experience working in intensive or respiratory care settings demonstrated higher levels of knowledge, suggesting that ongoing professional development and specialization contribute to a deeper understanding of VAP prevention strategies. This finding underscores the importance of providing continuous education and training opportunities for ICU nurses throughout their careers [22]**.** Similarly, the influence of years of experience on adherence to VAP prevention practices emphasizes the role of practical training and mentorship in promoting best practices. Nurses with more experience were more likely to consistently implement VAP prevention measures, indicating that hands-on learning and role modeling play a crucial role in shaping clinical practice [23]. This finding highlights the need for structured clinical training programs and mentorship initiatives to support the development of VAP prevention skills among ICU nurses.

The higher levels of knowledge among younger nurses and the greater adherence to VAP prevention practices among male nurses raise interesting questions about the impact of demographic factors on competence and performance. These findings may reflect differences in educational experiences, learning styles, or professional socialization across age and gender lines [24]. However, further research is needed to explore the underlying reasons for these disparities and develop targeted interventions to ensure consistent knowledge and practice standards among all ICU nurses**.**

While this study provides valuable insights into the knowledge and practice of ICU nurses in preventing VAP in Erbil City, several limitations should be acknowledged. The cross-sectional design limits our ability to establish causal relationships between variables. Additionally, the reliance on self-reported data may introduce response bias. Future research should consider employing observational methods to assess actual clinical practices and longitudinal designs to track changes in knowledge and practice over time. Moreover, exploring the impact of targeted educational interventions on improving VAP prevention competencies among ICU nurses would provide practical recommendations for enhancing patient care and outcomes.

CONCLUSIONS

The study demonstrated that emergency nurses in Erbil have moderate levels of legal knowledge and attitudes towards legal issues, along with medium levels of interference in legal matters. This suggests that while there is a foundational understanding, significant improvements are necessary. Policymakers and healthcare providers should develop targeted educational interventions to enhance legal literacy among nurses. These programs should focus on key legal principles and practical applications to ensure nurses are well-prepared to handle legal challenges. By improving legal knowledge, nurses can provide better patient care, reduce legal risks and feel more confident in their professional roles. Enhanced legal literacy will ultimately lead to a safer and more effective healthcare environment.

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Conflicts of Interest

The authors declare no conflict of interest.

Ethical Statement

Ethical approval was obtained from the Scientific and Ethics Committee of the College of Nursing at Hawler Medical University.

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